

scattering; actually, in a dense fog, the mutual separation is of the order of twenty times the radius of the droplets. He imposes the further limitation that 'single scattering' alone is considered, the criterion for this (that is, for the absence of 'multiple scattering') being that doubling the concentration of particles in a sample doubles the scattered intensity.

The first of the three parts into which the book is divided is concerned with the development of general theorems for scattering by particles of arbitrary size, shape and composition.

The second part provides the theory necessary for the calculation of the scattering for a wide variety of special particles large and small compared with the wave-length, absorbing and non-absorbing, and of various shapes. This is by far the largest and most important part of the work and is the section that is certain to be widely consulted by applied scientists seeking aid with numerical calculations. Nearly every chapter contains new formulae and numerical results, and a valuable bibliography of numerical computations by the Mie theory is provided. There is an excellent chapter on the optics of a raindrop which includes a penetratingly critical review of theories of the rainbow and a full account of the theory of the glory, extended in a later chapter by a brief examination of the effect of the existence of surface waves.

The final part of the book consists of four short chapters on the practical application of the theory to the explanation of scattering phenomena in the domains of chemistry, meteorology and astronomy, and on the use of scattering and extinction measurements to derive estimates with varying accuracy of refractive index, size and distribution of sizes, shape and orientation, and chemical composition of the particles.

A valuable feature of this outstanding book, which should be the standard work for many years, is the comprehensive list of carefully annotated references at the end of each chapter.

JAMES PATON

COMPLEXOMETRIC ANALYSIS

The Analytical Uses of Ethylenediamine Tetraacetic Acid

By Prof. Frank J. Welcher. Pp. xvii + 366. (Princeton, N.J.: D. Van Nostrand Company, Inc.; London: D. Van Nostrand Company, Ltd., 1958.) 64s.

AN important development in chemical analysis during recent years has been the application of aminopolycarboxylic acids, especially ethylenediamine tetraacetic acid, as complexing agents. Many publications concerning the analytical uses of this acid have appeared, and Prof. Welcher's book provides a summary of information gleaned from the 963 bibliographical references listed at the end.

The author states that he has endeavoured to collect information from all papers describing the use of ethylenediamine tetraacetic acid in inorganic analysis, but that critical evaluation of each method has not been attempted and that the book is not intended as a manual of recommended methods, though details of many procedures are given with reports on interference, optimum conditions, and claims as to accuracy.

The book opens with a discussion of general principles, including complex-formation constants, titration methods, colorimetric determinations, and the effect of pH on complex-formation. Succeeding

chapters provide much information concerning end point detection, metal indicators, the use of masking agents, the determination of more than thirty metals, indirect methods for anions, and applications to polarography, amperometry, and qualitative analysis. Two chapters are devoted to the determination of calcium and magnesium in water and in a great variety of materials ranging from alloys, cements, and rocks to biological fluids and foods.

The subject-matter is mainly concerned with volumetric applications of ethylenediamine tetraacetic acid, but an interesting final chapter concerns the uses of the reagent to complex interfering ions, and thus facilitate more orthodox analytical work such as the colorimetric determination of bismuth, cobalt, and copper with diethyldithiocarbamate, the determination of mercury with dithizone, the spectrophotometric determination of beryllium in the presence of aluminium, the mannitol-boric acid titration in the presence of iron and other metals, the separation of the rare earths, and the gravimetric determination of uranium in the presence of other metals.

This book will be a very useful guide for the analytical chemist, though, as the treatment is mainly non-critical, many of the methods dealt with will call for some preliminary trials before being accepted for any specific purpose. However, this is in no way a criticism of Prof. Welcher's comprehensive compendium, which will be of the utmost assistance to those interested in the analytical chemistry of ethylenediamine tetraacetic acid. C. O. HARVEY

NOISE

Principles of Noise

By Dr. J. J. Freeman. Pp. x + 299. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1958.) 74s. net.

DURING the past few years considerable attention has been focused on the problem of detecting ever smaller signals; this requirement has been forced upon us from a number of quarters, prominent among which are radio, astronomy, and electro-medicine.

The detection of these small signals is accompanied by the desire for a theory applicable to the random fluctuations with which the signal may be associated. Although investigations into electrical noise date back to Johnson's classical paper in 1928, until recently there have been very few books written in an attempt to integrate knowledge throughout the whole field of noise, and even fewer which have approached it in a tutorial manner designed for a reader with little previous knowledge of the subject. This is the task which the author has set himself.

The preamble to his book consists of two chapters dealing with the fundamental mathematical tools with which to attack noise problems. Starting from the basic notion of Fourier series he leads in a simple manner to the idea of Fourier integral and transform. He also introduces the concept of power spectrum and its relationship to autocorrelation function. The chapter on probability covers the principles of this subject, giving insight into the idea of variate space and leading from the notion of discrete probabilities to that of a continuous probability density.

The main text starts with a definition of random processes. Mention is made of the properties of